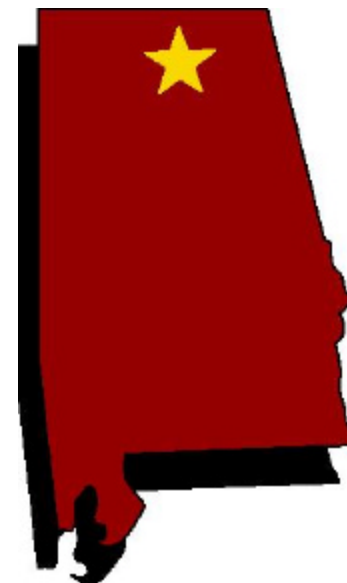




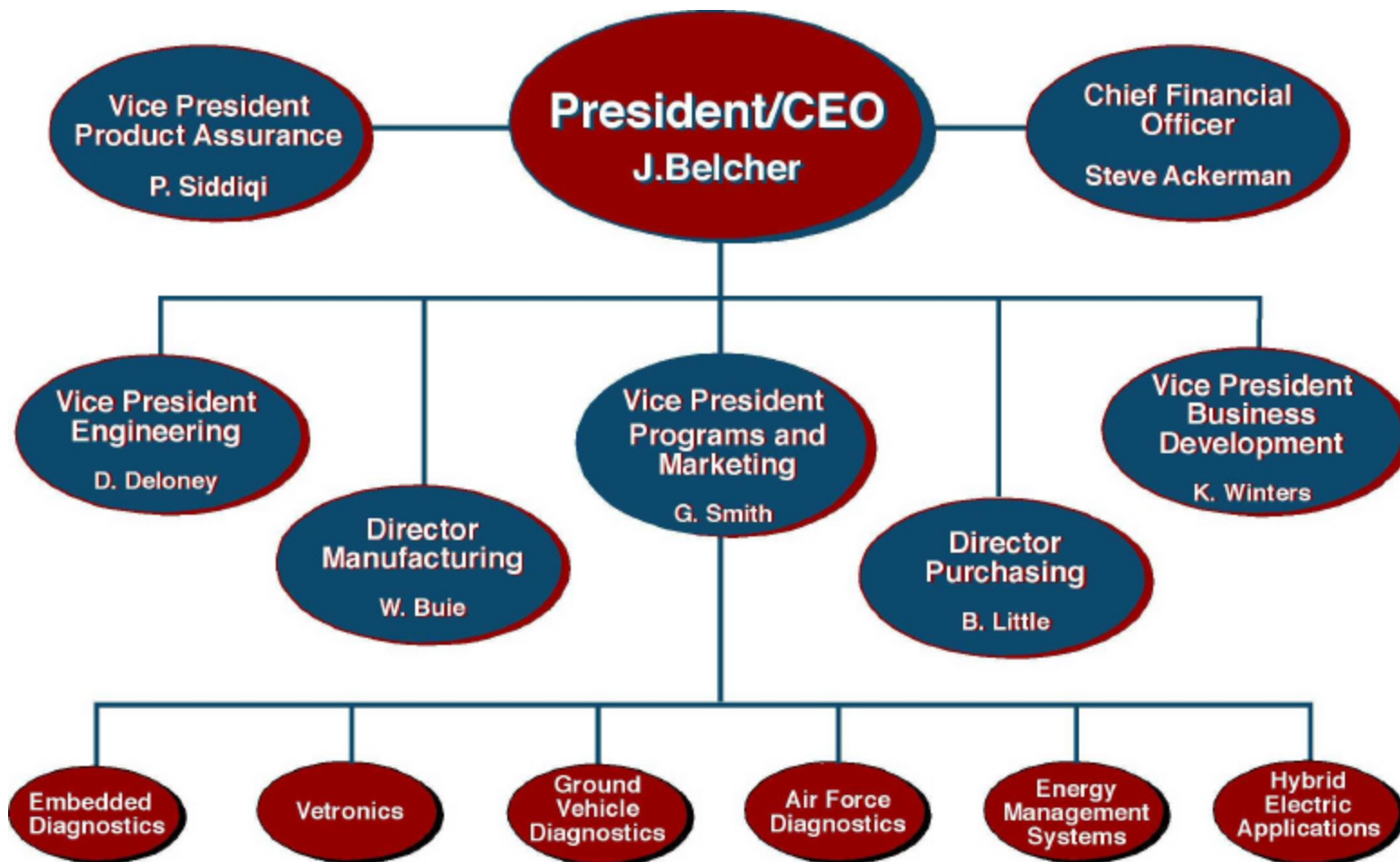
# Who is PEI Electronics?



- **Originated in the Defense Division of Chrysler Corporation**
  - **1950's and 60's--**
    - ◆ Space Division designed and produced the Saturn 1B Booster Rocket for NASA
  - **1970's**
    - ◆ Electronics Division developed test sets for the XM-1 Tank
    - ◆ Military/Industrial Group developed TOW missiles, ATE, and utility power grid control systems
    - ◆ In 1976, PEI entered the electric vehicle and component development market
  - **1980's**
    - ◆ Began development of fully integrated electric and hybrid-electric power trains for commercial and military markets
    - ◆ Evolved into a Vetronics provider for Ground Combat Vehicles
  - **1990's**
    - ◆ Expanded Diagnostics capabilities to include Electro Optics Testing and USAF Missile Systems
    - ◆ Expanded development of HE vehicles
    - ◆ 1996 -- Pentastar Electronics was purchased by local investors when Chrysler moved to divest itself from "military" business
    - ◆ 1998 -- PEI Electronics purchased by Veritas Capital



# PEI's CFT Focused Organization



# PEI's Products



**RSTS**



**CUSTOM  
AUTOMATED  
TEST EQUIPMENT**



**VETRONICS**

**VEHICLE POWER  
DISTRIBUTION**

**DSESTS**



**APPLICATION  
PROGRAM  
SETS**



**RUGGED  
COMPUTERS**



**EMBEDDED  
DIAGNOSTICS**



**SIDECAR**



**ELECTRIC  
HMMWV**

**HYBRID-ELECTRIC VEHICLE  
PROPULSION TECHNOLOGY**

# Sidecar Module and Cables

- **Capabilities**

- Built in Test (BIT)
- Single DC Samples
- Periodic DC Samples
- Fast DC Samples/Waveform Diagnostics
- CANBus J1939 Protocol
- Data bus speed up to 1MHz
- 120 Signal/Reference Inputs
- 8 Unique Address Configuration Lines
- Accuracy: +/- 0.01 Volts



- **Power**

- 6-10VDC, 310mA

- **Environmental**

- Operating Temp -40C to +85C
- Storage Temp -55 to +125C
- Submersible to 60 inch
- Shock up to 200G

- **MTBF > 27000 hours**

- **Cables**

- 7 Different Lengths
- Circular Ruggedized Connectors and Chemically Resistant



# **M1A1 EMBEDDED DIAGNOSTICS**



## **Why Embedded Diagnostics?**

- **Provides Improved Accuracy of Diagnosing Failures**
- **Improved Accuracy Reduces NEOF Rates**
- **Allows the Logistics Pipeline to More Accurately Match Actual Failures**
- **Allows More Efficient Use of Maintenance Personnel**

# ***MPC850 Common Diagnostics Processor***

- **Capabilities:**

- 6U VME 64x Communications Controller
- Motorola MPC850 processor operating at 50 Mhz with a 50 Mhz local system bus, operating at up to 66 MIPS
- Conduction-cooled (- 40°C to +75°C operating temperature)
- 16MB of SDRAM and 4MB of flash
- IDE192 Mb Compact FLASH II drive
- 2 USB Host controllers
- Dual CAN Bus interfaces, Mil-Std-1553B Bus Controller
- Ethernet 10baseT
- RS232/422/485
- Discrete I/O
- 8-bit Ultra SCSI interface
- WinRiver VxWorks Board Support Package



***Supports the M1A1, Bradley and MLRS Embedded Diagnostics Programs***

# **M1A1 EMBEDDED DIAGNOSTICS**



## **Why Embedded Diagnostics?**

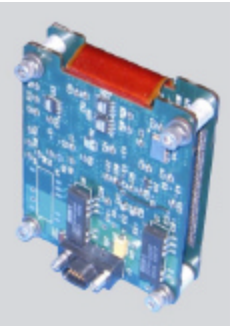
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# **M1A1 EMBEDDED DIAGNOSTICS**



## **System Elements**

- **Sidecar Modules - External and Embedded**
- **Sidecar Cables**
- **Sidecar Interface Assembly**
- **Embedded and PC-based Host Controllers**
- **Test Strategy Analysis**
- **Diagnostic Software**
- **Interactive Electronic Tech Manuals**



# **M1A1 EMBEDDED DIAGNOSTICS**



## **Current Program Goals/Objectives**

- **Develop Embedded M1A1 Built-In Test/Fault-Isolation Test (BIT/FIT) Software Enhancing and Replacing STE-M1 Capabilities**
- **Achieve Fault-Isolation to a Single LRU 100% of the Time**
- **Replace Current Alternate Trouble-Shooting Procedures with BIT/FIT, When Feasible**
- **Develop Interactive Electronic Technical Manuals (IETMs) for Diagnostic Routines Plus LRU Removal & Replacement**

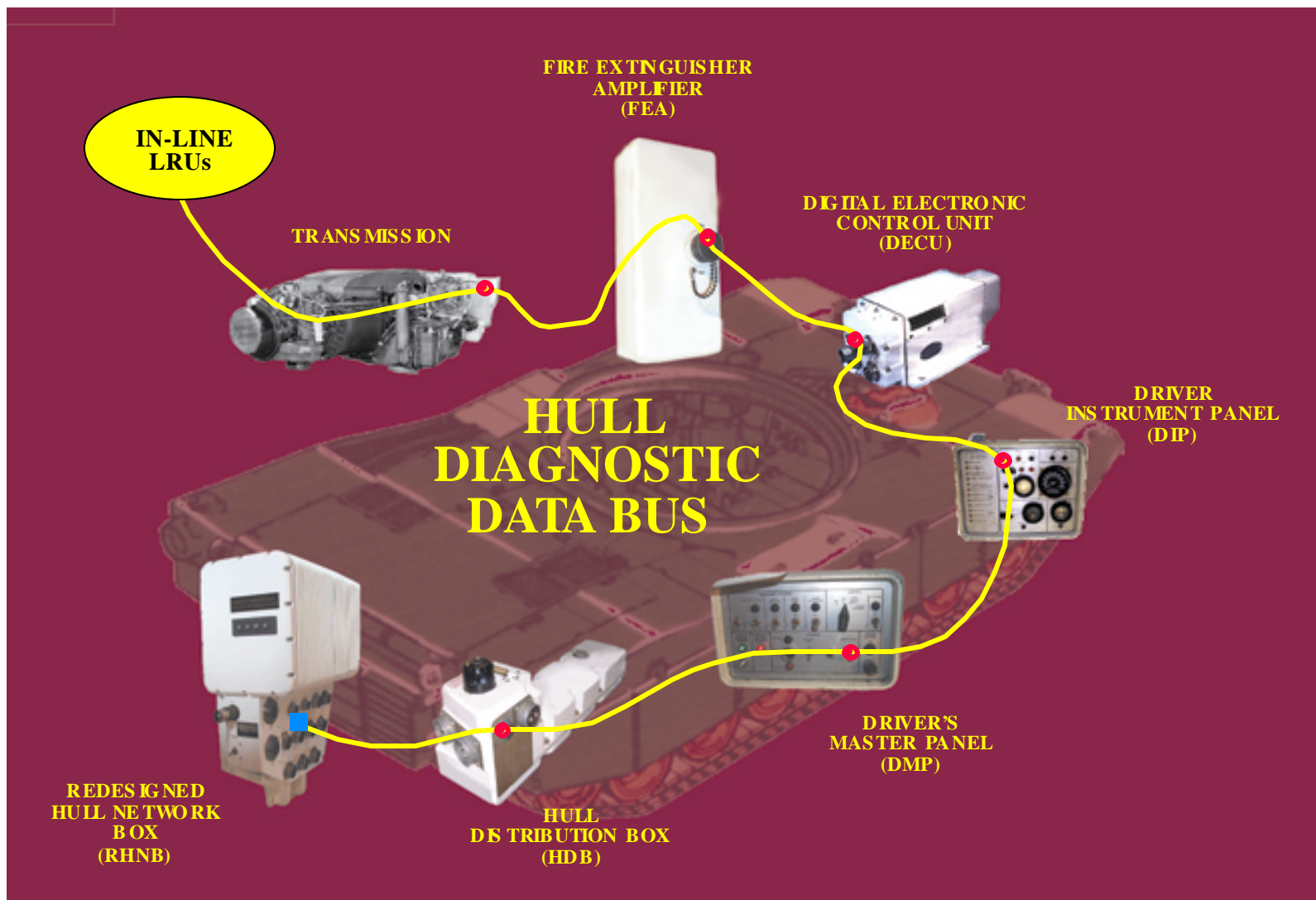
# **M1A1 EMBEDDED DIAGNOSTICS**



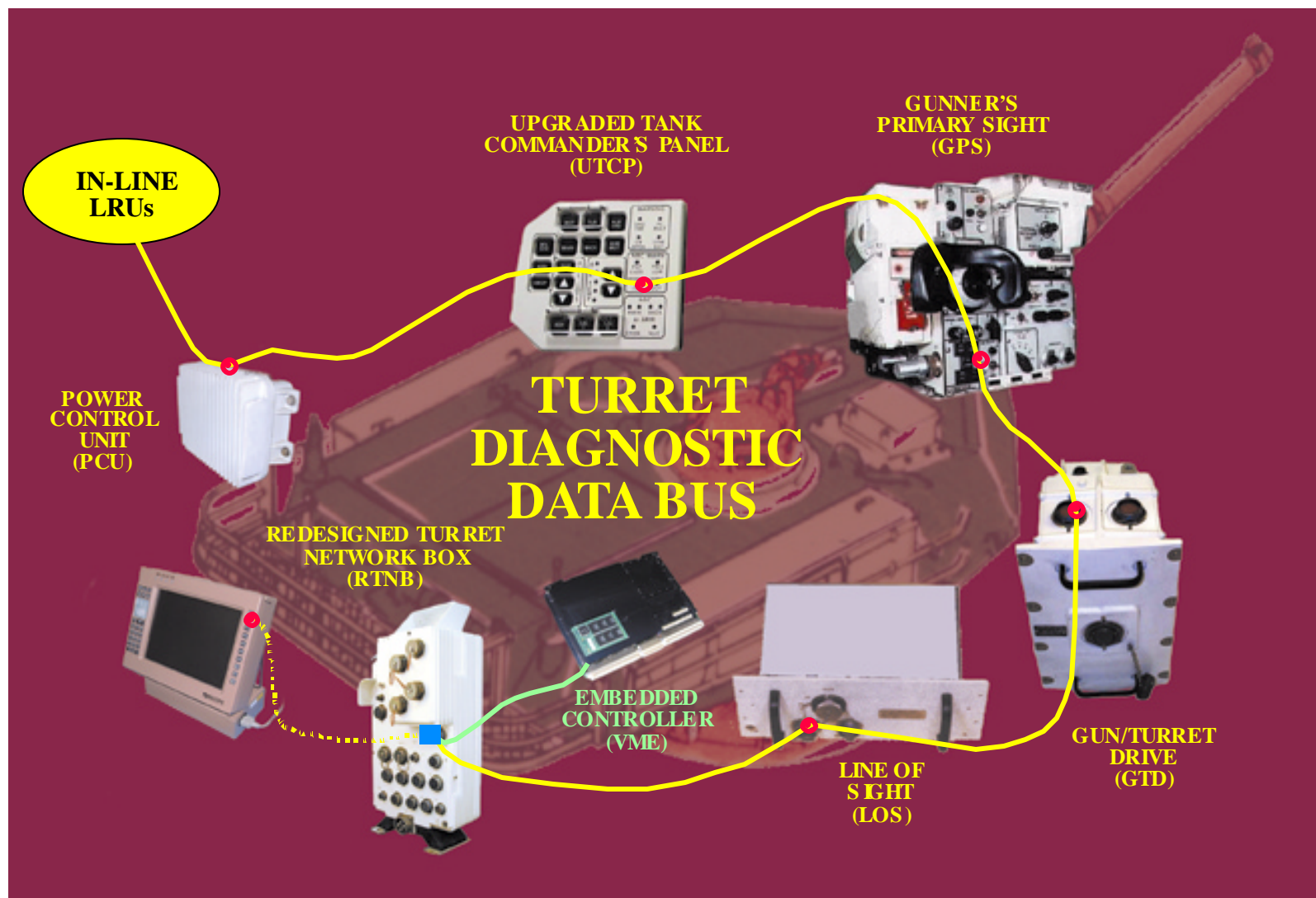
## **M1A1 AIM Configuration ED Hardware Components**

- **Sidecars™ embedded into the RTNB and RHNB**
- **VME Diagnostics Processor in the RTNB**
- **VME / Sidecar™ System Power Supply in RTNB and RHNB**
- **Sidecars™ on Test Connectors with Personality Cables**
- **Mounting brackets for external Sidecars™**
- **Sidecar™ Cables provide bus and power**
- **Carry-on maintenance laptop PC (SPORT) used for Full Diagnostics**

# M1A1 EMBEDDED DIAGNOSTICS

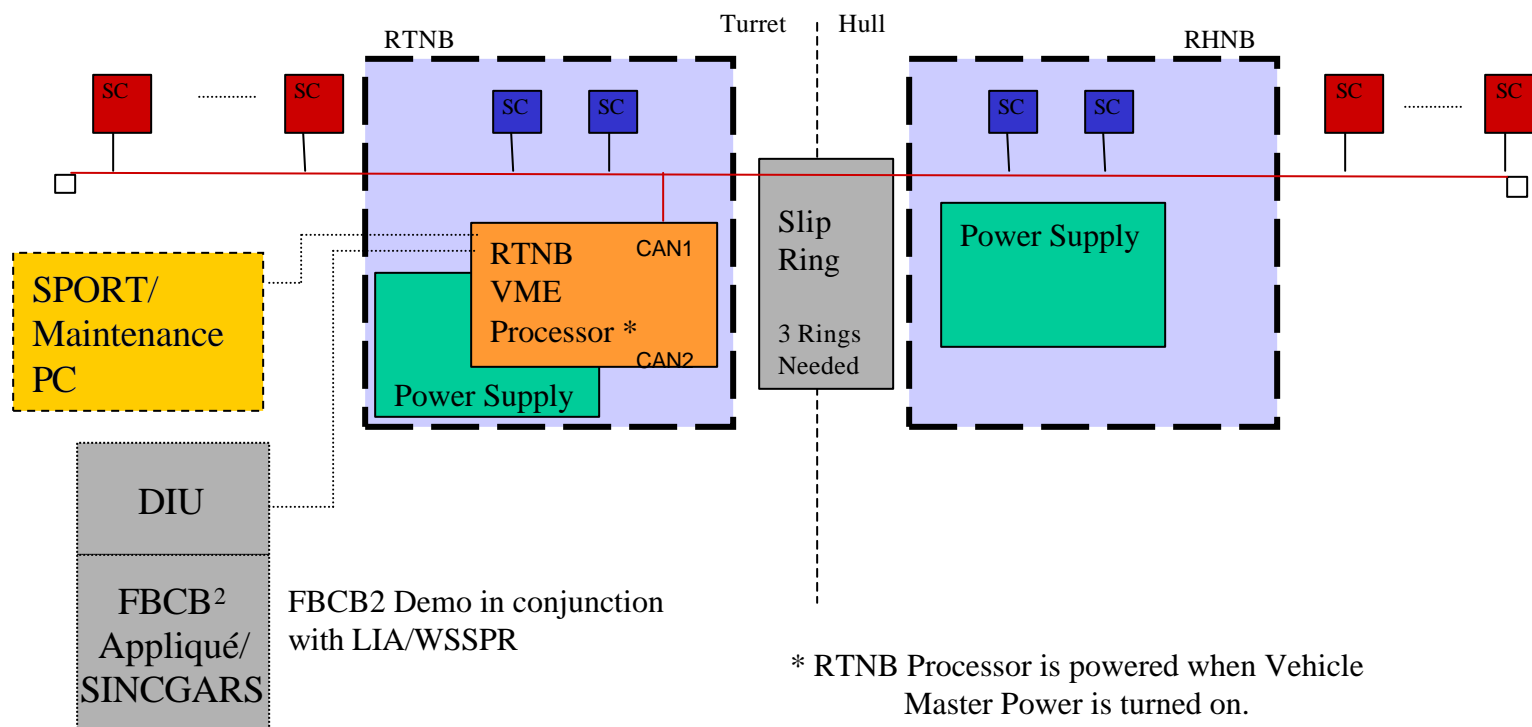


# M1A1 EMBEDDED DIAGNOSTICS

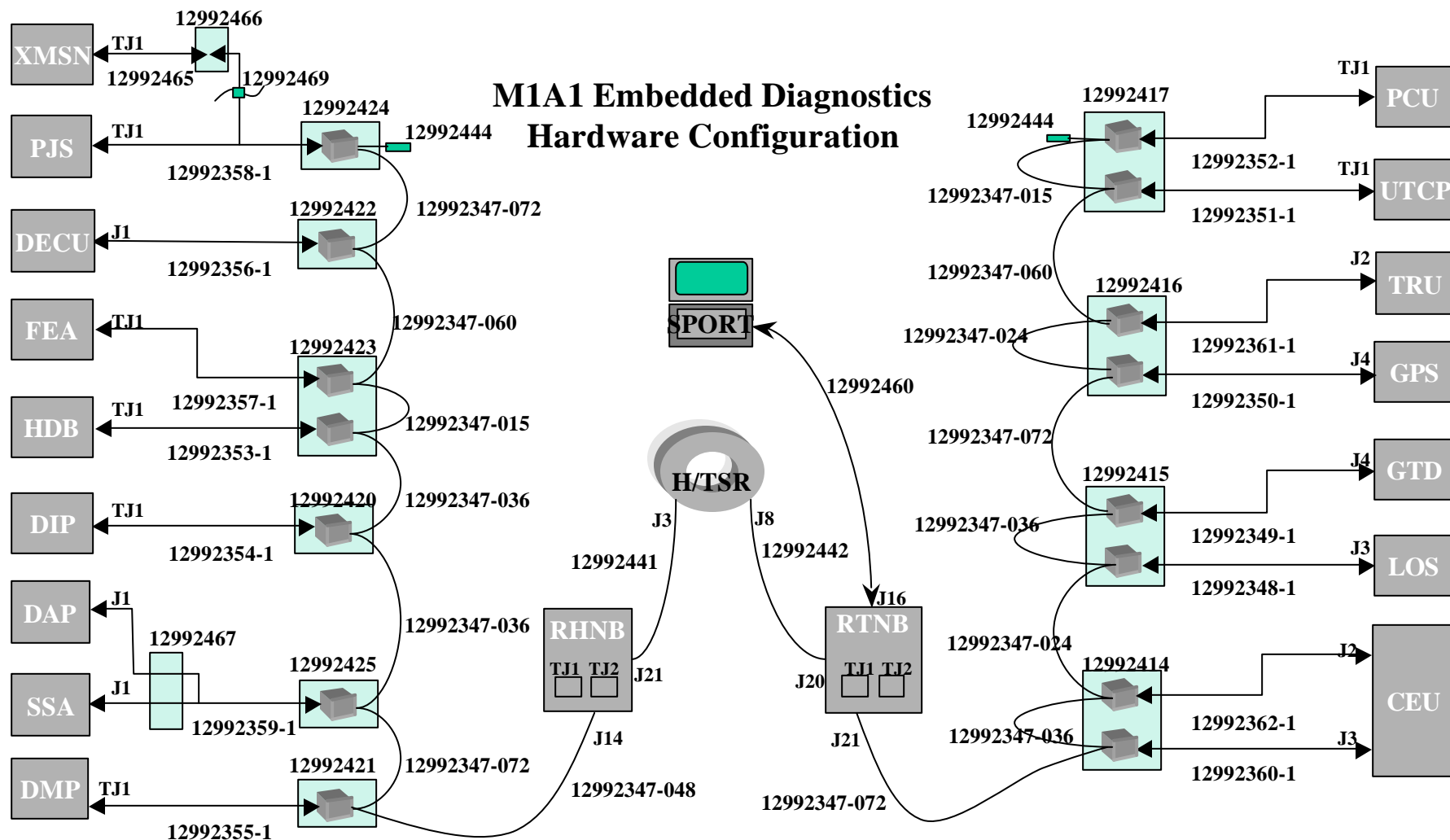


# M1A1 EMBEDDED DIAGNOSTICS

## - System Configuration -



# M1A1 EMBEDDED DIAGNOSTICS



# **M1A1**

## **EMBEDDED DIAGNOSTICS**



### **Health Check**

- **Testing of functions that can be verified operational without operator interaction or external input/manipulation**
- **HC Diagnostics run continuously without operator interaction**
- **Measurements & Faults are recorded into a recursive buffer**
- **Fault diagnosis without operator interaction are performed when appropriate**

### **Full Diagnostics**

- **Use of operator interaction to setup vehicle scenarios to verify proper operation of vehicle functions**
- **FD routines are performed upon maintainer request**
- **Diagnostics can be performed in system sub-sections or full vehicle checkout**
- **Diagnostic testing and fault isolation are accomplished through operator interaction via an IETM/GUI type interface.**

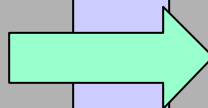
# **M1A1**

## **EMBEDDED DIAGNOSTICS**



### **Full Diagnostic Software**

- User Interface
- TPS Manager
- Sidecar BIT
- Calls IETM (IADS)

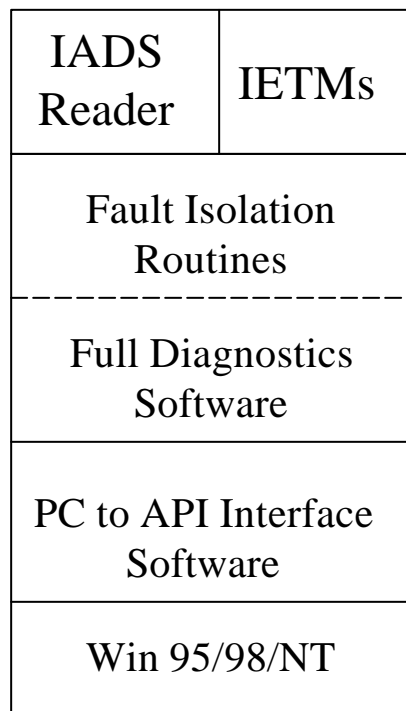


- IETM
- IADS Viewer
- Art Viewer
- Follow-ons
- R & R

# M1A1 EMBEDDED DIAGNOSTICS



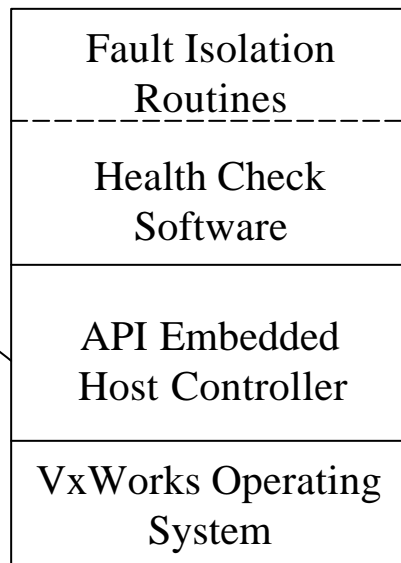
## ED Software Components



SPORT

RS-232

### RTNB



VME Processor CCA

On Vehicle

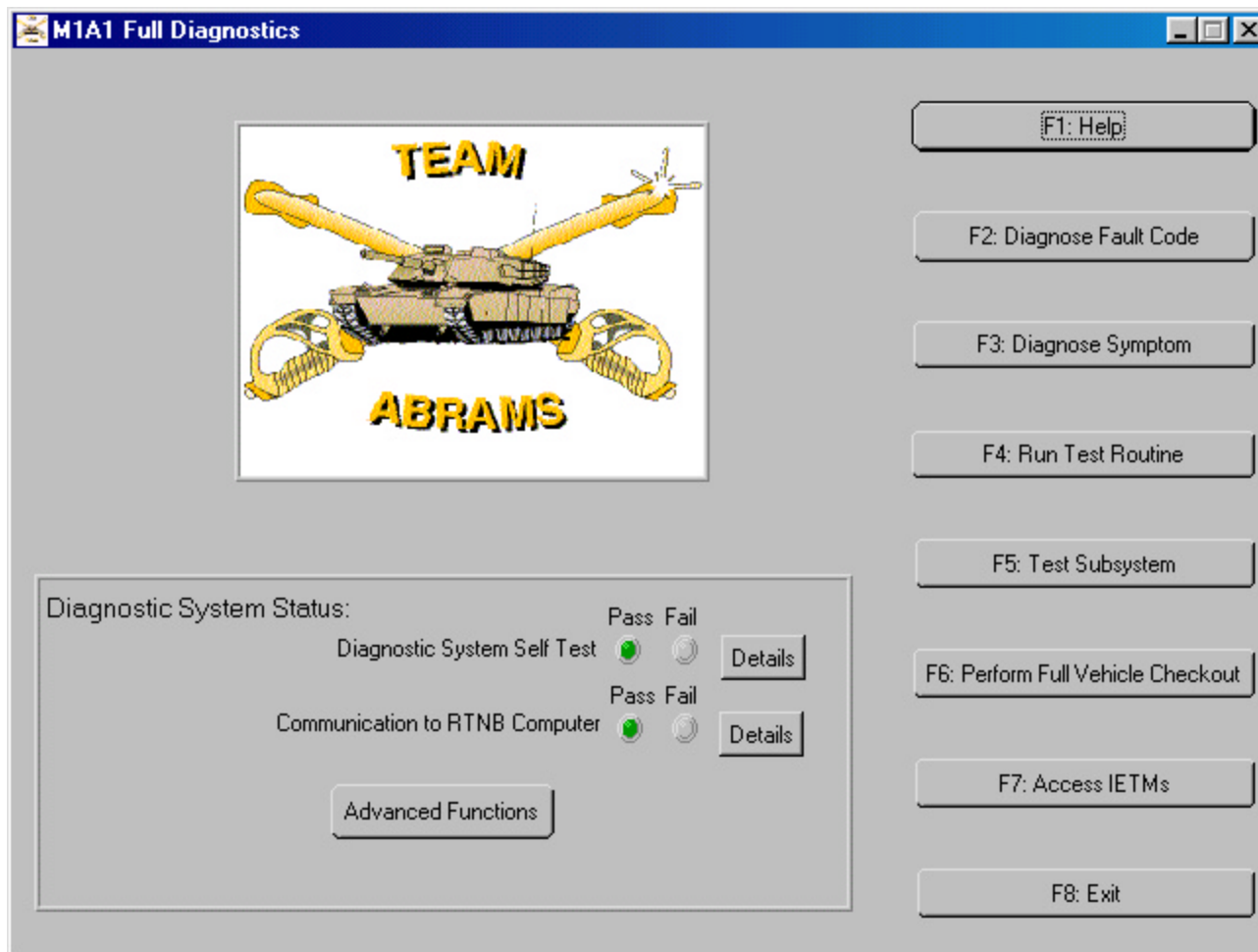
CANbus

Turret Sidecars

slipring

Hull Sidecars

# M1A1 EMBEDDED DIAGNOSTICS



# **M1A1 EMBEDDED DIAGNOSTICS**

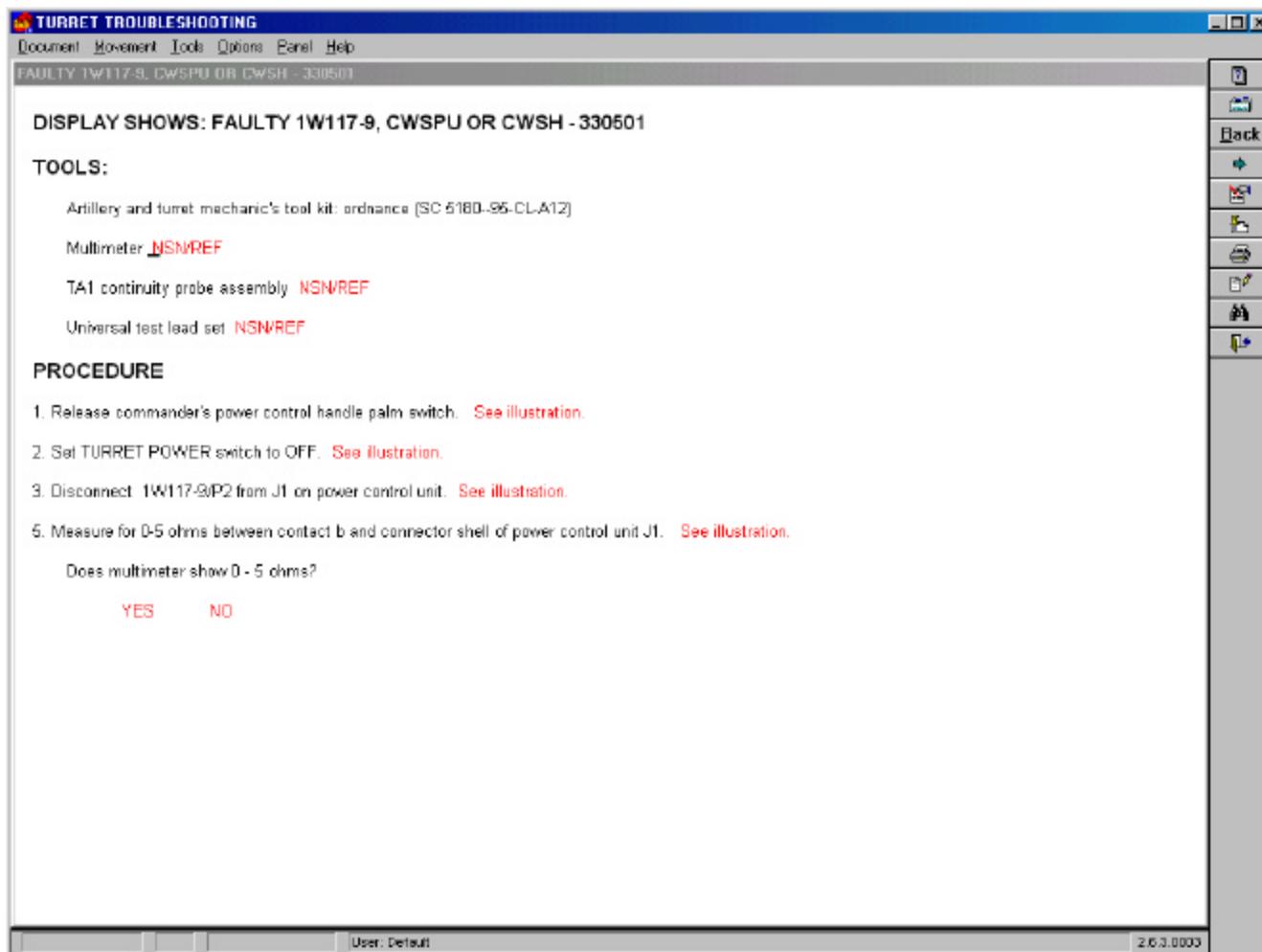


## **Interactive Electronic Technical Manuals (IETMs)**

- **M1A1 Embedded Diagnostics IETMs provide two separate functions:**
  - **TPS IETMs (IETPs)**
  - **Removal & Replacement IETMs**
- **IETPs provide an operator interactive means for Follow-on Troubleshooting Procedures (FTP)**
- **Removal & Replacement IETMs are linked to the diagnostic TPS fault diagnosis**
- **Removal & Replacement IETMs replicate the instructions of the existing TMs for removal and replacement of LRUs**

# M1A1

## EMBEDDED DIAGNOSTICS



# **M1A1 EMBEDDED DIAGNOSTICS**



## **M1A1 ED and M1A1 STE Execution Times**

Run Time Reduction (in minutes)				
Test	STE	ED	Time	%
1040	68	12	56	82%
1103	63	12	51	81%
1240	68	12	56	82%
1300	68	12	56	82%
1438	66	10	56	85%
Self Test	43	7	36	84%

\* ED Times for 1300 and Self Test are actuals, the remainder are estimates.  
All execution times include equipment setup and run times.